Can the Plasmaspheric Plume Significantly Contribute to Magnetosheath Densities?

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Intervals of strong magnetospheric convection electric fields can result in the removal of large portions of the outer plasmasphere and its transport to the vicinity of the magnetopause. Of growing interest is the disposition of that plasma and its possible influence on the processes operating in the regions contributed to by this dense thermal plasma of ionospheric origin. Plasmaspheric plasma may recirculate within the outer magnetosphere through the flanks to become part of the plasmasheet, be entrained on reconnected magnetic field lines drawn anti-sunward over the polar cap, or be lost into the magnetosheath flow and into the solar wind. Of interest here is whether it is reasonable to anticipate that the plume material is sufficient to contribute substantially to magnetosheath densities at the magnetospause where it could influence reconnection between the interplanetary and terrestrial magnetic fields. We present the results of model simulations of plasmaspheric plume and magnetosheath plasmas in the context of several storm-time event periods. Plume and magnetosheath densities are compared as a function of location and storm phase. The short answer is, “yes”, but not always and not at all locations. The full answer will be presented.

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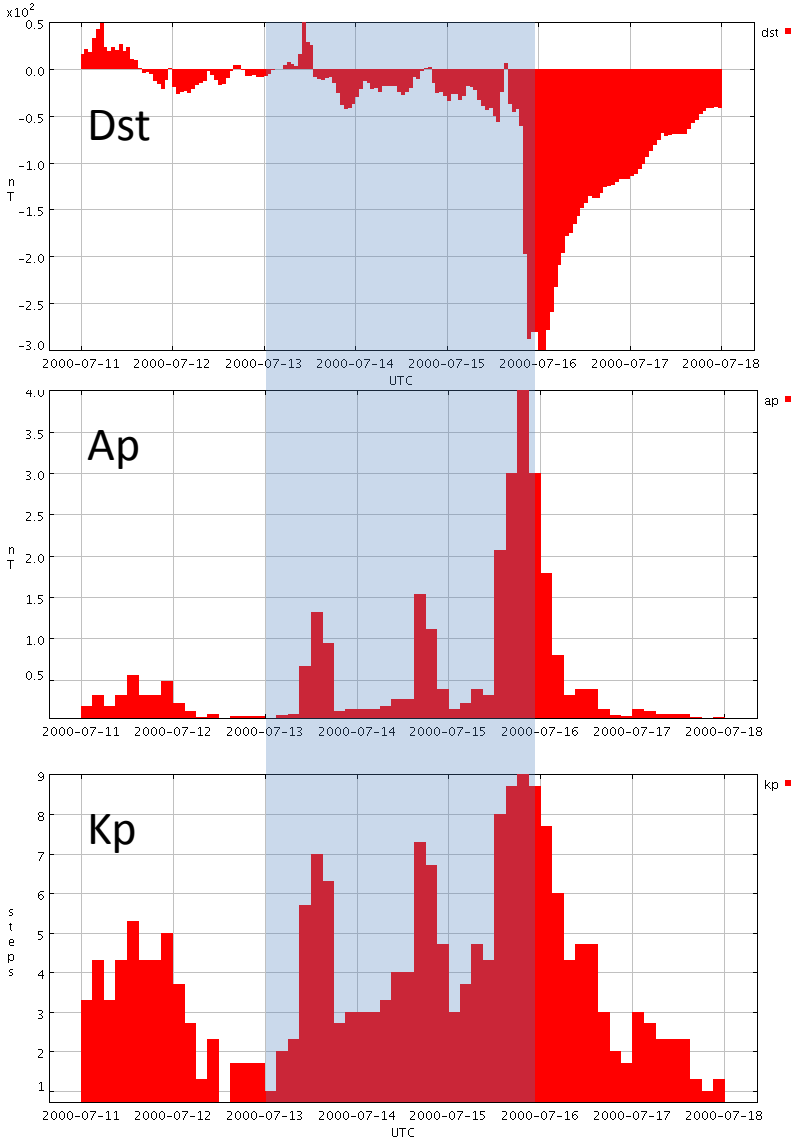
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-2.0
-2.5
-3.0
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UTC
Ap
ap
nT
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
2000-07-11 2000-07-12 2000-07-13 2000-07-14 2000-07-15 2000-07-16 2000-07-17 2000-07-18
Kp
kp
steps
9
8
7
6
5
4
3
2
1
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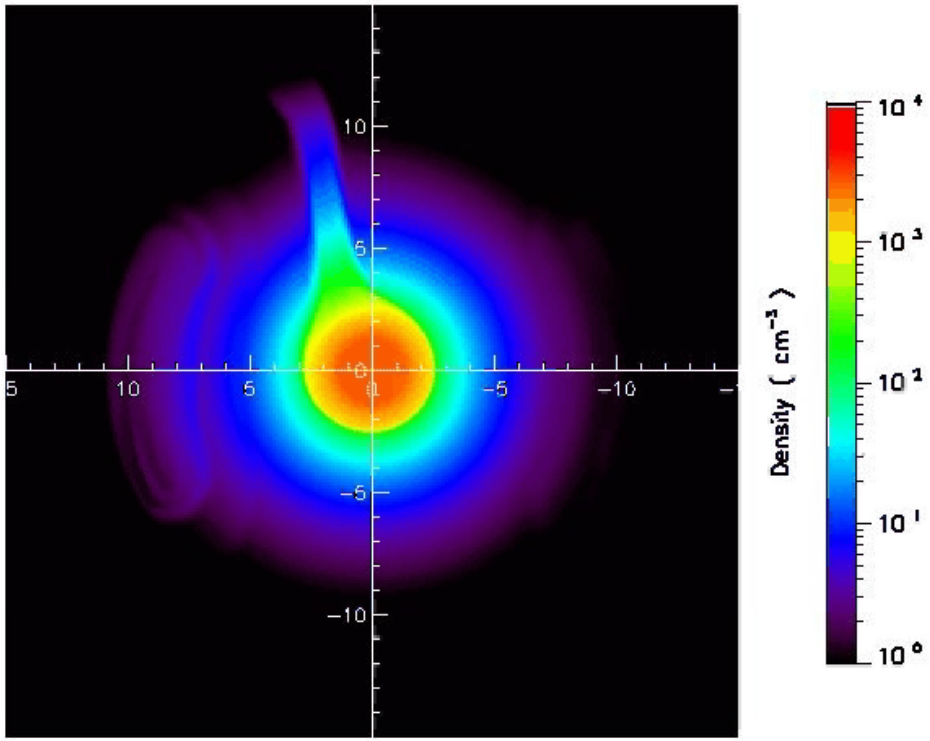
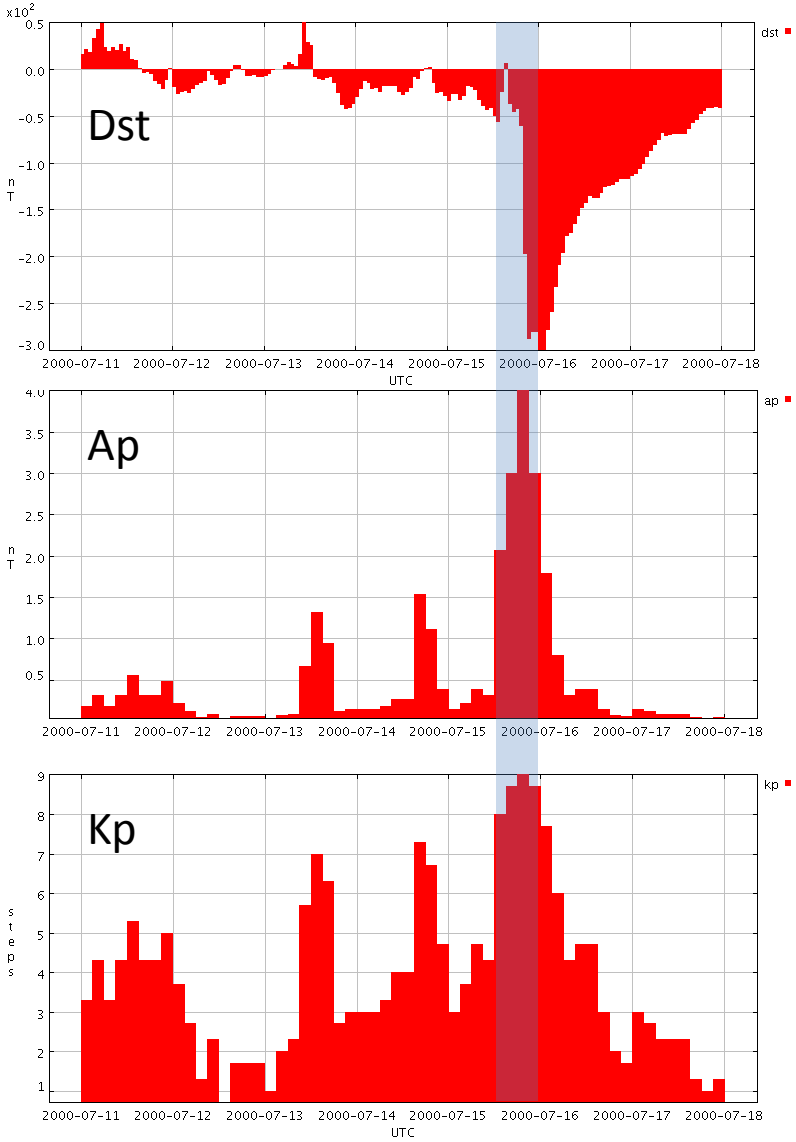

10
5
0
-5
-10
5
10
5
-5
-10
Density (cm⁻³)
10⁴
10³
10²
10¹
10⁰


Dst
Ap
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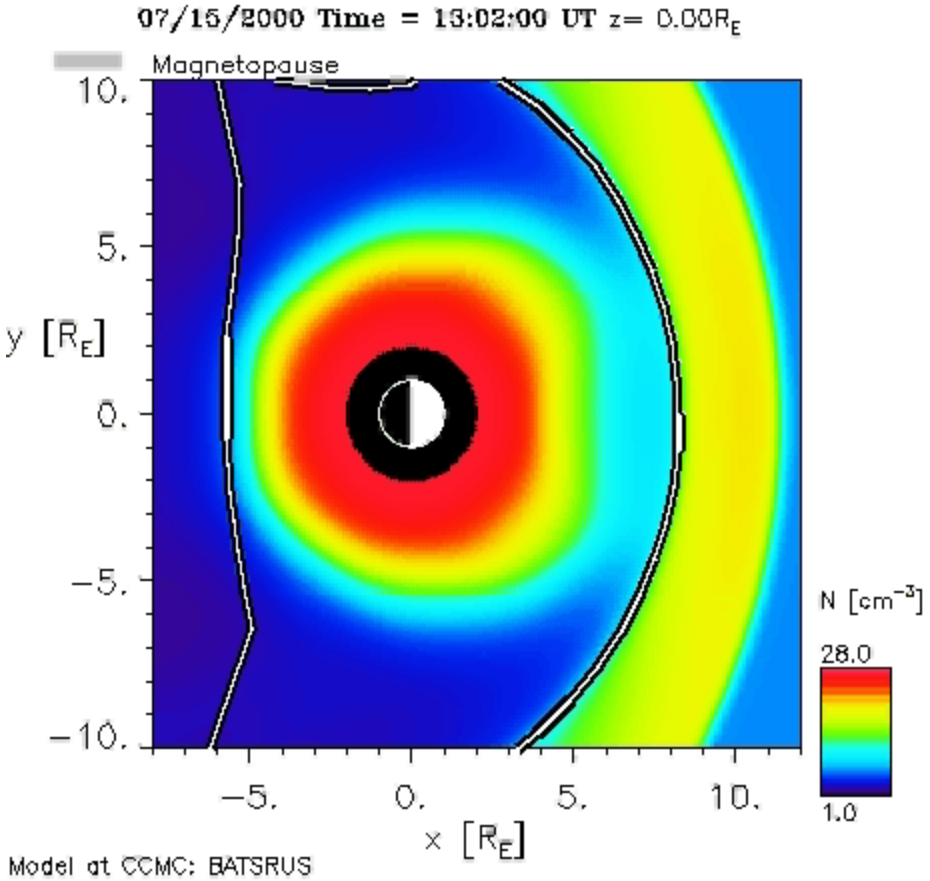
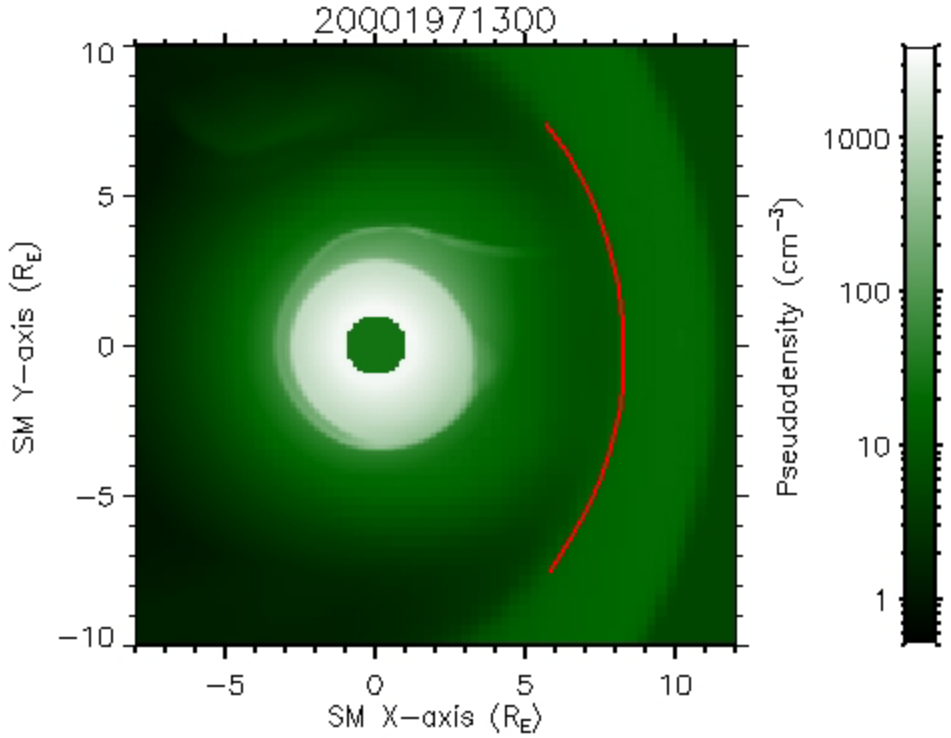

07/15/2000 Time = 13:02:00 UT z= 0.00R_E
Magnetopause
y [R_E]
x [R_E]
N [cm^-3]
28.0
1.0
Model at CCMC: BATSRUS


20001971300
10
5
0
−5
−10
SM Y−axis (R_E)
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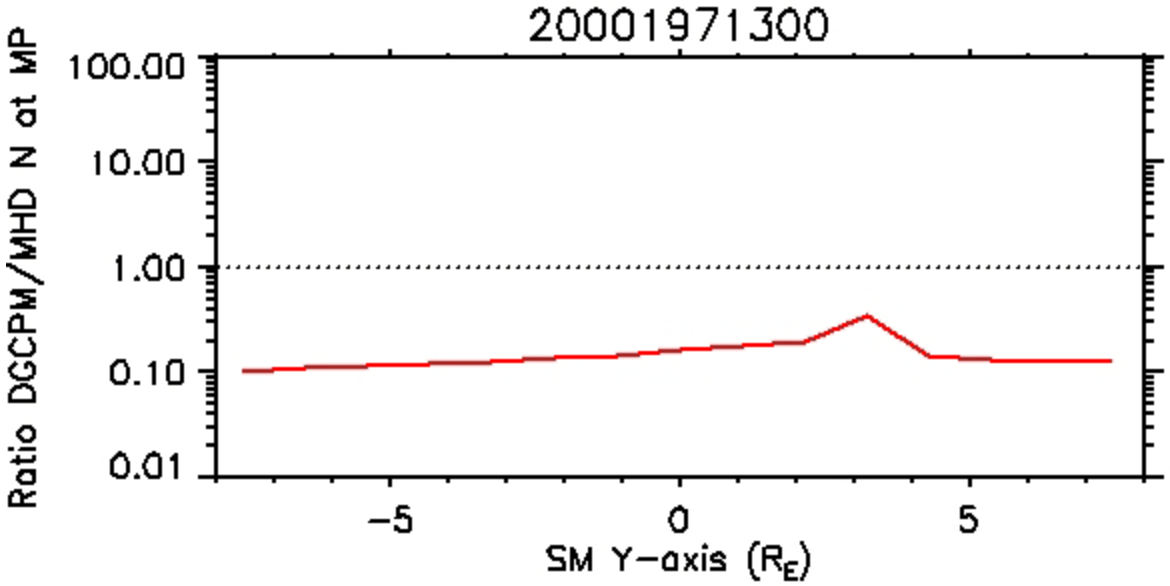
0
5
10
SM X−axis (R_E)
1000
100
10
1
Pseudodensity (cm^{-3})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100.00
10.00
1.00
0.10
0.01
Ratio DGCPM/MHD N at MP
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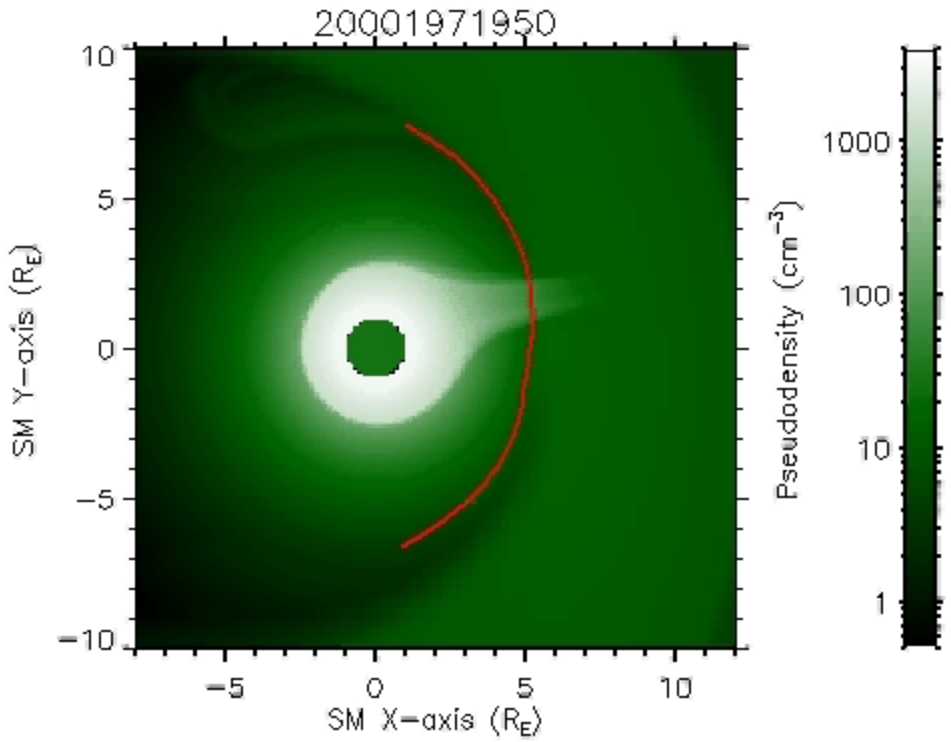
0
5
SM Y−axis (R_E)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SM Y-axis (R_E)
SM X-axis (R_E)
Pseudodensity (cm^{-3})
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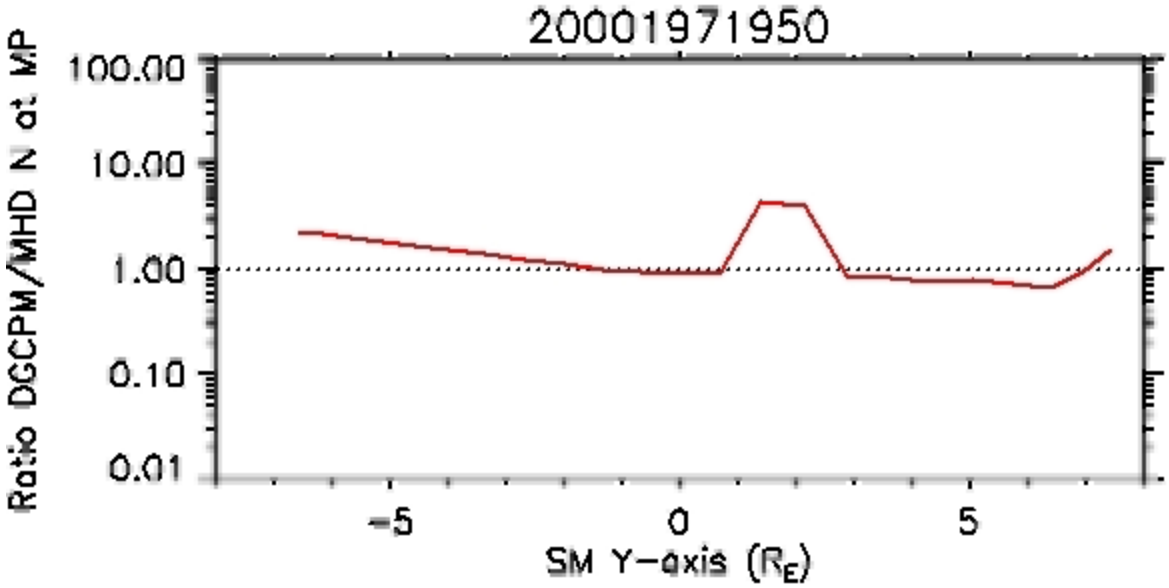
5
0
-5
-10
1000
100
10
1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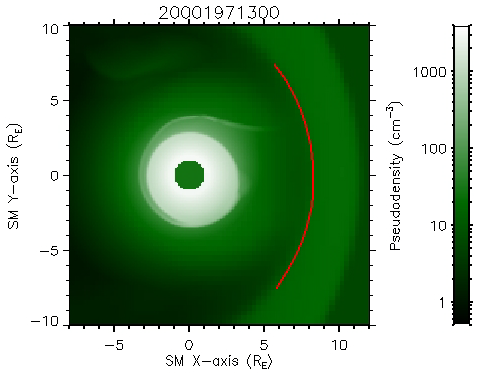
Ratio DGCPM/MHD N at MP
SM Y-axis (R_E)
100.00
10.00
1.00
0.10
0.01
-5
0
5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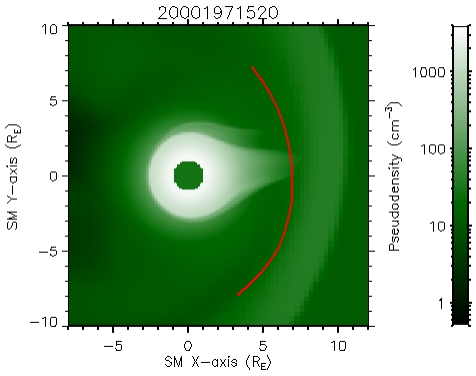
SM X-axis (R_E)
Pseudodensity (cm^{-3})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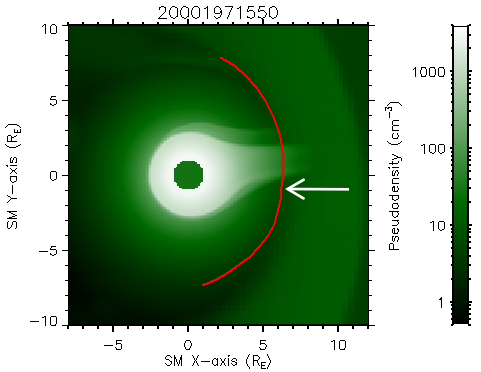
SM X-axis (R_E)
Pseudodensity (cm^{-3})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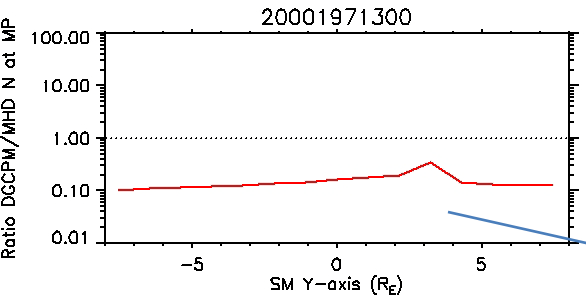
SM Y-axis (R_E)
SM X-axis (R_E)
Pseudodensity (cm^{-3})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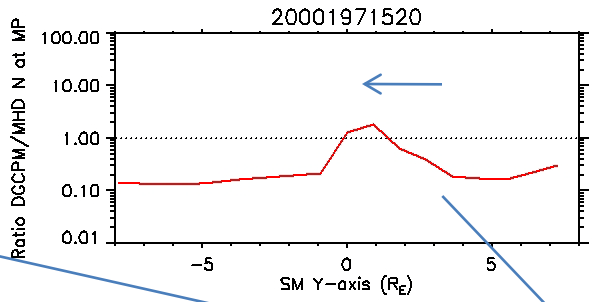
Ratio DGCPM/MHD N at MP
SM Y-axis (R_E)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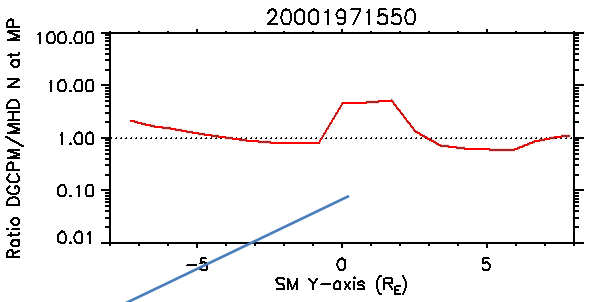
Ratio DGCPM/MHD N at MP
SM Y-axis (R_E)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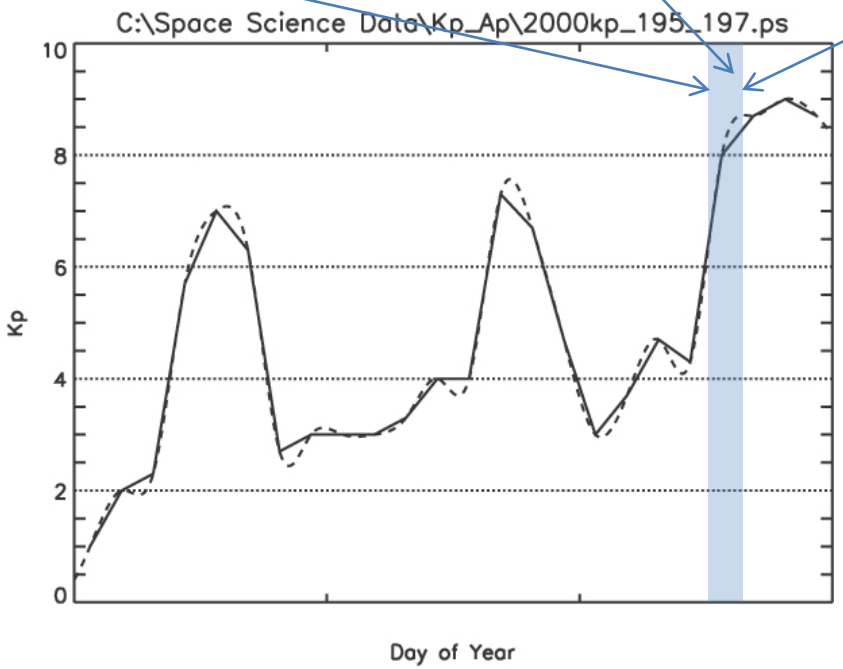
Ratio DGCPM/MHD N at MP
SM Y-axis (R_E)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Day of Year